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GREEN HERITAGE IN N. E. REGION AND ITS CONSERVATION

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ABSTRACT

Large variation in altitude, soil, temperature and rainfall of the North-eastern region has contributed immensely to the rich biological diversity. The region is also considered to be home of several primitive angiosperms, centre of speciation, with substantial endemics and progenitors of many cultivated and other economic plants *viz., Amomum, Cardamum, Citrus, Dioscorea, Musa, Piper, Prunus, Pyrus, Rubus, Trichosanthes, Zingiber* and orchid etc. It is appropriately considered as a cradle of plant evolution. However, the man himself disrupting the natural ecosystems at a terrifying rate, and in many parts of the region, these limits have already been transgressed resulting in the depletion of genetic wealth considerably. As a result, several plant species have already dwindled in natural habitats, while a few are on the verge of extinction.

In the present paper the rich bio-diversity met within this region along with its threat has been highlighted. Conservation strategy for their survival has also been discussed.

INTRODUCTION

The North-eastern region is considered as one of the richest bio-diversity centres of the Indian sub-continent. It is characterised by high rainfall and humidity. The annual rainfall is usually above 2,000 mm, although, there are rain-shade belts also. Similarly, the relative humidity is usually 80% during the morning hours. The altitude also varies from near sea level to 5,500 m; the climate ranges from that of tropical plains to temperate and alpine hills. The soil is rich in organic matters, iron content but very low or sometimes deficient in Boron, Calcium and Zinc; the pH of soil usually ranges from 4.5 to 5.5. Due to these various factors, the region represents one of the richest botanical regions in our country. There is no need to deal with the vegetation of this region, as it is fairly known through the contribution of Hooker, 1906; Burkill, 1925; Kanjilal *et al.*, 1934; Bor, 1938, 1942; Naik & Panigrahi, 1961; Rao, 1968, 1974; Rao & Panigrahi, 1961; Rao & Joseph, 1965; Panigrahi & Joseph, 1966; Rajkhowa, 1961; Deb, 1961, 1981; Sahni, 1969, 1981; Balakrishnan, 1981; Jain, 1982; Joseph, 1982; Mehra *et al.*, 1983; and Haridasan & Rao, 1985 etc.

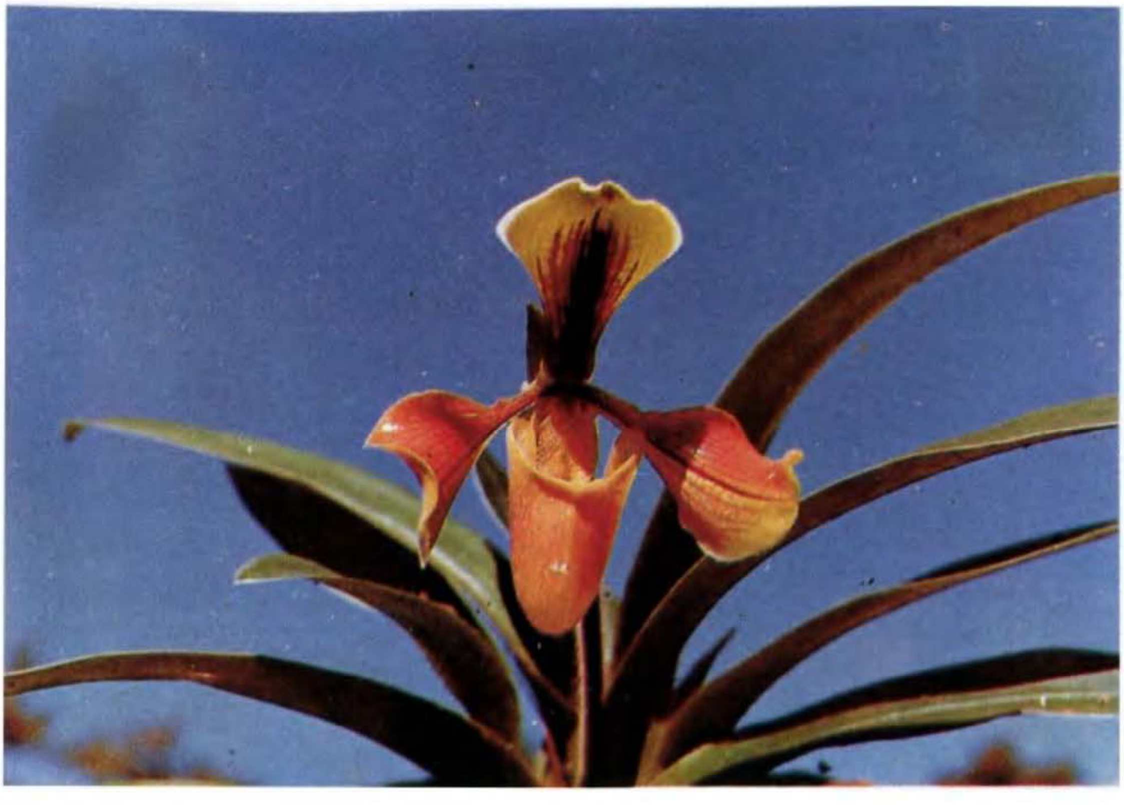
DIVERSITY

So far the flora is concerned, it is lush green, pristine and shows maximum diversity. The angiospermic flora is spread over *ca* 223 families (dicots *ca* 184 families and monocots *ca* 39 families) without any family endemic to this region. Out of these, many families *viz.*, Actinidiaceae, Aponogetonaceae, Bromeliaceae, Burmaniaceae, Butomaceae, Buxaceae, Cannabaceae, Cannaceae, Ceratophyllaceae, Chloranthaceae, Crypteroniaceae, Datiscaceae, Erythopalaceae, Erythroxylaceae, Flagellariaceae, Juncaginaceae, Lardizabalaceae, Moringaceae, Myricaceae, Najadaceae, Nepenthaceae, Nyctaginaceae, Plantaginaceae, Rhizophoraceae, Ruppiaceae, Saururaceae, Sparginiaceae, Taccaceae, Tetracentraceae, Trilliaceae, Triuridaceae, and Zannichelliaceae etc. have been represented by a single genus only, while some other families like Agaraceae, Balanophoraceae, Betulaceae, Droseraceae, Hydrophyllaceae, Phytoloccaceae, Polymoniaceae, Pontedariaceae, Rafflesiaceae, Stemonaceae, and Tamaricaceae are represented by two genera each. The herbaceous family Ranunculaceae is well represented and many species *viz.*, *Aconitum lethale* Griff., *A. nagarum* Stapf., *A. nakoi* Tamura, *A. novoluridum* Munz, *Clematis apiculata* Hook. f. & Thoms., *C. fulvicoma* Rehder & Wilson, *C. meyeniana* Walp, and *C. tongluensis* var. *khasiana* (Bruhl.) Kapoor etc., are endemic.

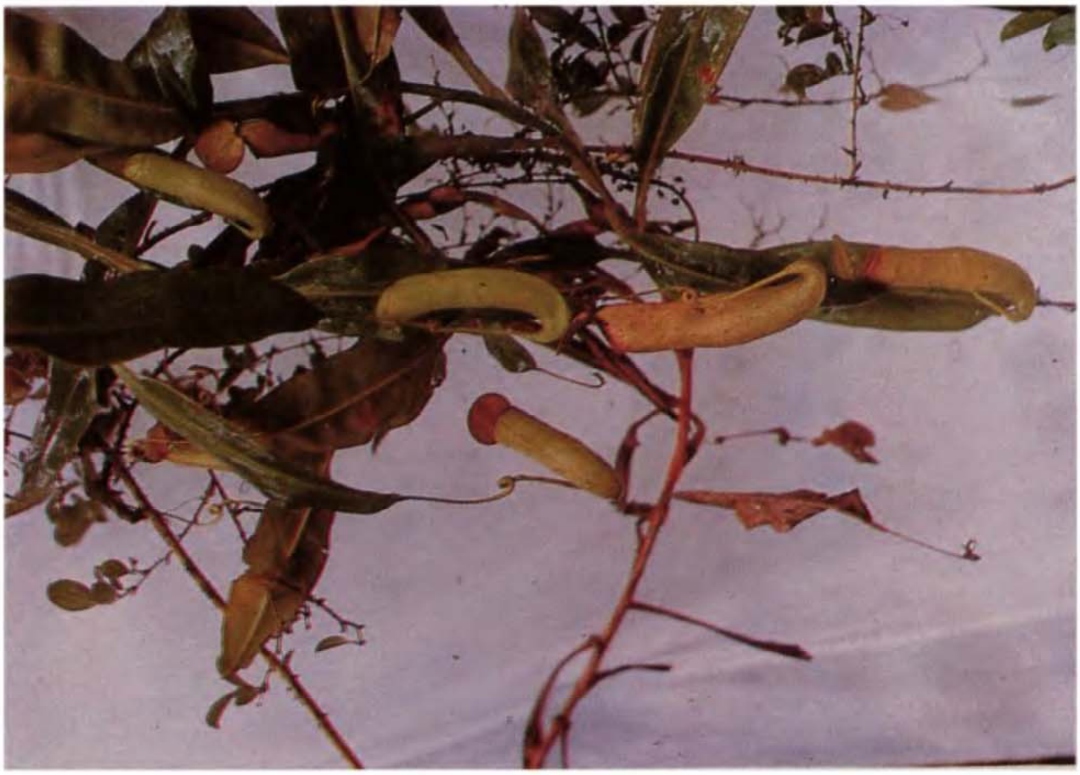
The Balsaminaceae is also richly represented by 44 species of *Impatiens* Linn., and the solitary species of *Tytonia triflora* (Linn.) C. E. Wood. Several species *viz.*, *Impatiens acuminata* Hook. & Thoms., *I. assamica* Bruce, *I. bracteolata* Hook. f., *I. cothurnoides* Fischer, *I. depauperata* Hook. f., *I. gibbisepala* Hook. f., *I. khasiana* Hook. f., *I. laevigata* Hook. f. & Thoms., *I. longirama* Hook. f., *I. odontosepala* Hook. f., *I. porrecta* Hook. f., *I. racemulosa* Hook. f. & Thoms., *I. rubro-lineata* Hook. f., *I. scitula* Hook. f., *I. spissiflora* Hook. f., and *I. terniflora* Hook. f., are endemic (Chauhan, 1982a). The species of *Argimonia, Cotoneaster, Crataegus, Docynia, Eriobotrya, Fragaria, Geum, Kerria, Micromeles, Niellia, Potentilla, Poterium, Prinsepia, Prunus, Pygeum, Pyrus, Rosa, Rubus, Spriracea* etc., contribute the rich gene pool of family Rosaceae. Bignoniaceae is also a rich family and species like *Begonia adscendens* Clarke, *B. foveolata* Fischer, *B. obversa* Clarke, *B. palmata* D. Don var. *gamblei* (Irmsch.) Hara, *B. sureuligera* Kurz, *B. wattii* Clarke and *B. wingeri* Fischer etc., are endemic. The Cucurbitaceae and Moraceae have been represented by 45 species of each family. Vacciniaceae and Ericaceae harbour *ca* 70 spceies, of which more than 60 species are endemic to Assam and Burma. The N.E. region can take pride in having more than 58 species of Rhododendrons of great ornamental value all over the World. Mention may be made about few rare, endemic and ornamental species *viz.*, *Rhododendron concinnoides* Hutch. & Kingdon Ward, *R. alliotii* Watt ex Brandis, *R. falconeri* Hook. f. subsp. *eximum* (Nuttall) Chamberlain, *R. formosum* Wall. var. *formosum*, *R. formosum* Wall. var. *inaequale* (Hutch.) Callen, *R. johnstoneanum* Watt ex Balf. f., *R. triflorum* Hook. f. var. *bauhiniflorum* (Watt ex Hutch.) Cullen and *R. wattii* Cowan etc., whose population has been depleted considerable in nature (Sastry & Hajra, 1983). The Podostemonaceae with liverwort like fresh water taxa *viz.*, *Dicrea acuminata* (Wed.) Tul., *D. minor* (Wed.) Tul., *Hydrobryum griffithii* Tul., *Polypleurum filifolium* (Raman. & Joseph) A. S. Rao & Hajra, *P. stylosum* (Wight) J. B. Hall., *P. wallichii* (R. Br.) Tul., etc. Once reported abundance could not be sustained for long, probably due to highly contaminated / polluted water. Similarly, *Aldrovanda vasiculosa* Linn. could not be collected after its first report from Manipur (Deb, 1957).

Interestingly, many primitive families e.g. Magnoliaceae, Illiciaceae, Annonaceae, Schisandraceae, Lardizabalaceae, Hamamelidaceae, Chloranthaceae, Lauraceae etc., show their maximum concentration only in this region within India, and is considered as primary centre of origin of angiosperms (Takhtajan, 1969). Contrary, Smith (1970) and Van Steenis (1971) speculate that the South-east Asia plexus with numerous folds of mountains is a 'refugium' and not a cradle of flowering plants. In this region, the family Orchidaceae is followed by Poaceae and Cyperaceae (Rao & Verma, 1982). The Zingiberaceae is represented by *Amomum, Boesenbergia, Cardamum, Costus, Globa, Hedychium, Mantisia* and *Zingiber* etc. Some of taxa e.g. *Amomum pauciflorum* Baker, *Boesenbergia rubroluta* (Baker) O. Ktze. *Globa marantina* Linn., *Mantisia wingeri* Fischer, *Zingiber intermedium* Baker and ten species of *Hedychium* (Srivastava, 1983) are endemic. The N. E. region is very rich in palms and Bamboos. The latter, which are well known for their multipurpose economic uses e.g. making of houses, baskets, brooms, mats, poles, fencing, water pipes, bows and arrows and other cottage industries etc., have also been represented by *ca* 64

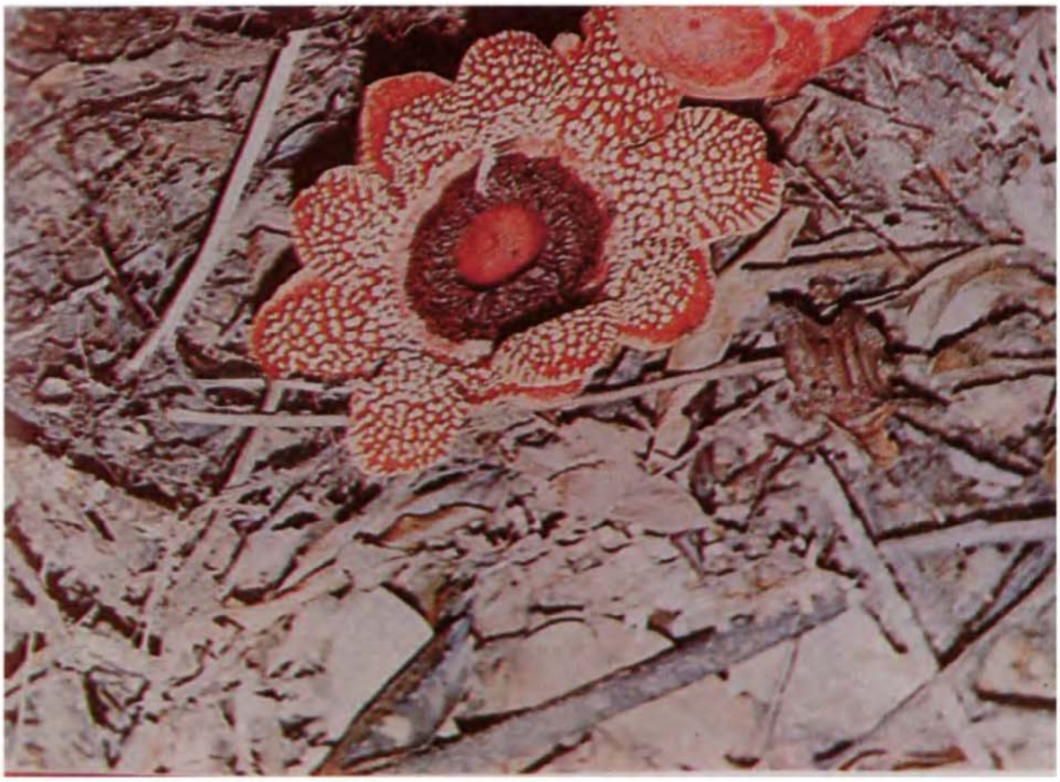
1a. A view of Tropical evergreen forest in North-eastern region



1b. *Paphiopedilum villosum* (Lindl.) Stein- a beautiful ornamental orchid from Mizoram.



2a. *Nepenthes khasiana* Hook. f.- a rare and endemic pitcher plant from Meghalaya.



2b. *Sapria himalayana* Griff.- a rare and interesting root parasite of the family Rafflesiaceae.

taxa, out of 116 taxa, reported from India (Majumdar, 1989). Certain taxa like *Bambusa, Chimonobambusa, Chimonocalamus, Dendrocalamus, Drepanostachyum, Gigantochloa, Phyllostachys, Schizostachyum* and *Yushania* etc., are of great economic value. The other fascinating group of plants, because of their beautiful, long lasting, ornamental flowers, is orchids. More than 600 species of orchids flourish in this region, which include a substantial number of endemic species and many highly ornamentals like *Aerides, Bulbophyllum, Coelogyne, Cymbidium, Dendrobium, Paphiopedilum, Phaius, Pleione, Renanthera, Rhynchostylis* and *Vanda* species etc. Apart from indigenous elements and substantial endemism, many, near-by Nepal, Bhutan, Indo-Burma, Sino-Himalayan, Malaysian and to a lesser extent with peninsular Indian affinity, could be colllected from this region, probably as they belong to a single natural mountain land, the Indo-Chinese subregion biogeographically (Mani, 1974). Besides, the taxa like *Eurya nitida* Korth., *Hypericum laxum* (Bl.) Koidzani, *Mitrastemon yamamotoi* (Makino) Makino, *Viola diffusa* Ging. ex DC. etc., are the best examples of Sino-Japanese affinity through Burma and China. Few plants of African and American flora are naturalised in the North-eastern region. They are generally exhibited by weeds of agricultural land scapes or are brought under cultivation. Attention may be drawn to *Boschniackia himalaica* Hook. f., a root parasite of Orobanchaceae and *Pyrularia edulis* A. DC (Santalaceae) which have one species in North-eastern India and Eastern Himalayas and another solitary one in America and are the best examples of transpecific distribution. Besides, a number of exotics have been introduced in this region either in the afforestation programmes or under water management programmes due to their known high productivity and better nutritional values.

A number of taxa *viz.*, *Aristolochia griffithii* Hook. f. & Thoms. ex Buck., *Balanophora dioica* R. Br., *Epipogium roseum* (D. Don) Lindl., *Galeola lindeleyana* Reichb. f., *Lilium davidii* Duchar, *L. mackliniae* Sealy, *Rhopalocnemis phelloides* Jung, *Sapria himalayana* Griff. etc., of botanical curiosities have also been reported. *Nepenthes khasiana* Hook. f., *Drosera burmanii* Vahl, *D. peltata* Sm., and ten species of *Utricularia* Linn. etc., are the best examples of insectivorous plants of the region. Other worth mentioning taxa are : *Amentotaxue assamica* Feruson, *A. cathayensis* Li, *Cycas pectinata* Griff., *Ephedra* sp., *Eurale ferox* Salisb., *Gnetum gnemon* Linn., *G. ula* Brongn., *Pinguicula alpina* Linn., *Cephalotaxus manii* Hook. f., *C. griffithii* Hook. f., *Tetracentron sinense* Oliver and *Zeylanidium olivaceum* (Gordn.) Engl. etc. The region also abounds in rich gene pool of primitive cultivars and land races. The genetic variability in *Alocasia, Amorphophyllus, Cajanus, Camellia, Canvallia, Malus, Mucuna, Prunus, Rubus, Trichosanthes, Vigna* etc., are prolific. The genus *Dioscorea* has been represented by 19 species with 13 varieties while *Piper* with *ca* 30 species. Several wild banana and *ca* 64 species of *Citrus* have been recorded, some of them are endemic to this area. It is imperative to mention here that *Asraoa, Biswarea, Bryocarpum, Hymenadra, Jejosephia, Lepidostemon, Neoluffa, Pauia, Parajaeschkea, Pleurospermopsis, Treutlera* etc., are endemic to N. E. region.

THREATS

However, in recent times due to unprecedented demographic pressures on account of population explosion, unplanned utilization of plant resources, slash and burn mode of agriculture, introduction of alien species and spread of harmful chemicals etc., have considerably affected the original species composition and floristic diversity of these tropical evergreen and semi-evergreen rain forests and have brought about qualitative changes upto a certain extent. With galloping population, food requirements have also increased tremendously. To meet the increasing demand of production, the period of jhum cycle has been reduced to 4-5 years in Meghalaya, 5-10 years in Mizoram and Tripura, 6-16 years in Manipur and Nagaland and

10-17 years in Arunachal Pradesh, providing practically no chance for natural regeneration of soil fertility. It is of grave concern that the reduction in the forest cover is still going on unabated in some states *viz.*, Assam, Mizoram, Tripura and Maghalaya. As a result, the rich genetic and ecological diversity has dwindled considerably and *ca* 700 plant species are facing threat in this region (Jain & Sastry, 1980; Jain & Rao, 1983; Sastry *et al.*, 1983; Nayar & Sastry, 1987, 1988, 1990; Chauhan, 1982 b; Chauhan & Singh, 1992), which need immediate protection. Nevertheless, a total of *ca* 1,000 sq. km of undisturbed natural vegetation are scattered in different parts of Meghalaya, have been protected by the tribals due to religious belief. These sacred groves e.g. Mawphlong, Cherrapunjee, Raliang, Lawpoh Lyngdoh, Shillong Peak and Swer, Pynursla, Laitryngew, Mawsmai, Mawmluh, Nartiang, Sangpung green blocks etc., not only give us an insight into the rich floristic heritage of Meghalaya, but also act as 'Store houses' of rich gene pool of plants, some of which are not even found outside the groves. Besides, these factors have not only aggravated natural calamities such as landslides, erosion of soil and floods in catchment areas, but also the vast area of the land has become barren and unproductive wastelands. Recently, a massive programme of afforestation, social forestry and other land utilization programmes have been launched to bridge the gap between demand and supply of natural resources, with species reference to the flora.

CONSERVATION

Judicious planning to facilitate perpetual utilisation of organic resources is the hall-mark of conservation, and envisages preservation or protection and rehabilitation of wild life in their natural habitats for long term scientific, aesthetic and economic utilization for the benefit of mankind. But today the development in a sense has become synonymous with deforestation and desertification and progress with pollution, due to the need of the poor, greed of the rich and careless application of the technology so much so that the UNCED (United Nations Conference of Environment & Development) has met at Rio in Brazil during June, 1992 to discuss global policies on environment and development in general and conservation of the tropical forests of the globe in particular. Therefore, the conservation of biological diversity has to be increasingly based on principles of genetic and evolution so'that long term genetic flexibility is not lost. Most of the diversity is found in forests and other wilderness areas where village or tribal people are in a commanding position, therefore, the state of local people will have to be developed by making them aware of their responsibilities and compensating them for their needs.

It is imperative to mention here that the *in situ* conservation of genetic resources through their maintenance within natural ecosystems in which they grow, is the most ideal system as this permits natural evolution to take place, safeguarding ecological integrity. As such, several sanctuaries, national parks and Biosphere reserves have been created within this region. However, it is not feasible, to institute gene sanctuaries for every economic or threatened species as *Citrus* and *Nepenthes* etc. So far the biosphere reserves are concerned only four potential sites, Kaziranga, Manas, Namdapha and Nokrek covering an area of about, 5,940 sq. km out of *ca* 1,21,828 sq. km forested area of this region, have so far been identified. As 60% of the whole of India's forests are in North-east India, it is imperative that more such reserves at different ecological niches are to be identified within this region. Such reserves can be established at Sessa-seppa, Arunachal Pradesh; Dzukou valley and Shiroy-kharasom areas of Manipur and Nagaland and Phawngpuitlang, (Blue Mountain) Ngengpui in Mizoram etc., as these forests are still harbouring pristine, lush evergreen vegetation with minimum human interference. Hence, more biosphere reserves of this nature should be established within this region. Another viable means for preservation of selected taxa is their *ex situ* conservation in botanical gardens, seed gene banks, pollen storage, cryopreservation pollen storage, genetic gardens and tissue culture techniques etc. The one disadvantage in this sort of conservation is that only a small number of individuals, which may represent a small fraction of genetic variability, can be preserved.

The Botanical Survey of India the apex organisation concerned with floristic resources of the country and its conservation is actively engaged in the inventorisation of rare, threatened and endemic taxa of the region, which are being published in the Red Data Book of Indian Plants. The Green Data Book pertaining to rare and threatened plants which have been brought successfully under cultivation in different botanical experimental gardens, orchidaria etc., is also under preparation for publication. Besides, micropropagatum of some rare and threatened and other ornamental orchids is being done by the tissue culture techniques under captive breeding programme. The judicious exploitation of the green heritage will help us in long-term improving the welfare of humanity and, at the same time, it will also facilitate to conserve this natural pristine glory for the posterity.

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